A08852

DISTRIBUTION AND MORTALITY OF REDHEADS BANDED IN NEW YORK[1]

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ABSTRACT

Redheads that winter in New York constitute less than 1 per cent of the continental population but afford important diving duck hunting in the State. Records for 10,388 birds banded in central New York during the winters of 1955 to 1960 provided information on distribution and mortality. Average first-year recoveries showed that 47 per cent were harvested north and west of New York, 24 per cent in New York, 26 per cent south and east of New York and a scattering elsewhere in the country. Data for individual years varied markedly. First-year recovery rates for the hunting seasons from 1955-56 through 1958-59 ranged from 7.0 to 8.7 per cent. Reduction of the bag limit in 1958-59 did not reduce the recovery rate because the lateness of the second half of the split season selected in New York resulted in more productive hunting. The recovery rates in 1959-60 and 1960-61 were limited both by bag restrictions and by the time of the open season. The data suggest that terminating the open season prior to late December would reduce the harvest of redheads only slightly while reducing that of canvasbacks substantially. The sex ratio for all birds averaged 78.5 males to 21.5 females, and a sample of first-year birds showed 75.8 males to 24.2 females. The proportion observed during aerial surveys was similar. Mortality rates for females during their first year, and usually their second year, were higher than those for males although the total rates were about equal. Evidence indicates that a high harvest of females occurs before the birds reach New York and that males predominate among both juveniles and adults throughout the fall. In New York, adult females were found to be 1.38 times as vulnerable to gunning as adult males. There is need for hunting regulations that would reduce the disproportionate loss of females.

On a continental basis, the number of redheads (*Aythya americana*) that winter in New York seems insignificant. Weller (1961), in discussing the distribution and migration of the species, suggested that those that winter in this state constitute only a fraction of 1 per cent of the continental population. Nevertheless, New York waterfowlers rate the redhead along with the canvasback (*Aythya vallisneria*) and the two scaups (*Aythya marila* and *A. affinis*) as important contributors to diving duck hunting. Some 5,000 to 15,000 redheads winter in the Finger Lakes region. Many thousands more migrate through the State to join the wintering population in the area from Chesapeake Bay to Pamlico Sound which Weller (1964) estimated as 11.9 per cent of the continental population.

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[1]A contribution of Federal Aid in Fish and Wildlife Restoration Project W-39-R. Much of the credit for banding goes to Robert L. Case and members of the Canandaigua Lake Diving Duck Association, R. Withington and the Northern Chautauqua Fish and Game Club, and R. A. Ryan of Hobart College at Geneva.

The first bandings of redheads in New York were made in the early 1920's by Dr. A. A. Allen (Schierbaum *et al., 1959*), but less than 1,000 were banded in the State prior to 1955. From 1955 through 1960 State personnel and cooperating sportsmens' organizations banded 10,388 redheads during January, February and March (Table 1). This paper is based on these bandings. Redheads banded elsewhere but recovered in New York are referred to when they supply useful information. However, some records for birds banded during the years 1961 to 1961 are used to assess sex ratios and rates of retrapping.

Following the practice of the U.S. Fish and Wildlife Service, all winter-banded birds taken after January 1 are considered adults since one leg of their annual migration has been completed. Many birds of the year were banded, but no accurate measure of the ratio of young to

TABLE 1. REDHEADS TRAPPED AND BANDED IN NEW YORK FROM 1955 TO 1960 DURING JANUARY, FEBRUARY AND MARCH

Year	Sex	Cayuga Lake	Seneca Lake	Canandaigua Lake	Dunkirk Harbor	Total	Sex ratio
1955.....	Male	17	255	317	85	701	78
	Female	4	78	102	17	201	22
	Total	21	333	419	102	905	xxx
1956.....	Male	36	972	1,204	238	2,549	76
	Female	20	341	325	141	827	24
	Total	56	1,313	1,608	399	3,376	xxx
1957.....	Male	1	333	388	181	858	74
	Female	..	130	161	52	343	29
	Total	3	463	499	236	1,201	xxx
1958.....	Male	7	233	571	76	887	78
	Female	3	38	176	29	246	22
	Total	10	271	747	105	1,133	xxx
1959.....	Male	..	545	928	47	1,520	83
	Female	..	110	172	21	303	17
	Total	.	655	1,100	68	1,823	xxx
1960.....	Male	..	481	1,160	.	1,641	84
	Female	..	113	196	..	309	16
	Total	..	594	1,356	..	1,950	xxx
Total.....	Male	63	2,819	4,627	650	8,159	78.5
	Female	27	810	1,132	260	2,229	21.5
	Total	90	3,629	5,759	910	10,388	xxx

adults could be made. Cloacal examination showed that young were taking on characteristics of adults during the months of trapping. Recoveries during the first hunting season for winter-banded birds are termed indirect returns because the birds have migrated north and gone through a breeding season before being subject to gunning.

No special effort was made to take one species of diving duck over another at the banding stations. The type of trap used, with minor

Table 2. Distribution of First-year Recoveries by Hunting for Redheads Banded in New York from 1955-56 to 1960-61

Recovery location	Year recovered						Total	
	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61	Number	Per cent
Breeding range								
Alberta	..	..	..	1	..	1	2	0.4
Saskatchewan	..	2	2	..	..	..	4	0.7
Manitoba	2	11	3	1	4	1	23	4.4
North Dakota	..	6	4	1	1	..	12	2.1
South Dakota	1	2	5	1	..	..	9	1.6
Minnesota	6	18	13	6	15	..	58	10.1
Migration route to Atlantic Flyway								
Wisconsin	5	6	6	3	2	1	23	4.1
Illinois	..	1	..	1	..	..	2	0.4
Michigan	10	27	17	14	12	..	80	14.0
Ontario	8	17	13	7	9	..	54	9.5
Ohio	..	..	1	..	..	..	1	0.2
New York	12	46	16	10	3	1	137	24.1
New Jersey	1	1	1	1	..	..	4	0.7
Pennsylvania	1	3	..	1	..	..	5	0.9
Maryland	12	71	15	14	1	..	113	20.9
Virginia	..	7	1	1	..	..	9	1.6
Massachusetts	..	..	..	1	..	..	1	0.2
Rhode Island	..	1	..	..	..	..	1	0.2
North Carolina	1	5	1	1	..	..	8	1.4
Florida	..	1	..	..	..	..	1	0.2
Other								
Wyoming	..	..	..	..	1	..	1	0.2
Kansas	..	..	2	..	..	..	2	0.4
Missouri	..	..	..	1	..	..	1	0.2
Kentucky	..	2	..	..	..	..	2	0.4
Louisiana	..	3	..	..	..	..	3	0.5
Texas	..	1	1	..	..	..	2	0.4
California	..	1	..	..	..	..	1	0.2
Total	79	238	101	91	51	4	567	100.0

individual variations, was that described by Schierbaum and Talmadge (1954). During the 6-year period 10,388 redheads and 10,553 canvasbacks were banded, but the relative numbers varied from year to year. In 1956 there were 3,376 redheads and 1,953 canvasbacks trapped. In 1957 the positions were reversed, i.e., 1,201 redheads and 3,697 canvasbacks. These differences related roughly to the numbers of birds present.

BREEDING AND WINTER RANGES

The distribution of recoveries for these winter-banded birds (Table 2) is one source of information on their breeding areas. These data suggest that Manitoba, Minnesota and the Dakotas were the breeding grounds that contributed the most redheads to New York. But these recoveries were made by hunting, and many of the birds may have moved after the breeding season before being subject to gunning.

More direct evidence came from birds banded on their breeding grounds and recovered in New York. The few records of this sort are shown in Table 3. These data suggest that Manitoba, Minnesota and North Dakota were important contributors of redheads taken in New York. Saskatchewan and Alberta also contributed. In the absence of records of the number banded, their relative importance cannot be appraised. Records presented by Lensink (1961) suggest a similar pattern of origin.

Weller (1961), using the records available to him, concluded that redheads reared in the eastern and northern portions of their range tended to migrate to the eastern wintering range. Those reared farther west in the prairie region tended to winter in Texas and Louisiana. No sharp dividing line separates these breeding populations.

TABLE 3. REDHEAD BANDED WITHIN LIMITS OF BREEDING RANGE AND RECOVERED IN NEW YORK

Banding location	Age when banded				Total
	Duckling	Juvenile	Adult	Unknown	
Alberta	1	..	..	..	1
Saskatchewan	1	..	2	..	3
Manitoba	..	23	12	1	38
North Dakota	3	1	3	.	7
Minnesota	8	6	1	..	15
Total	13	32	18	1	64

Birds trapped during the winter on a wintering area might be assumed to be winter residents. For redheads banded in New York, this was true only if the wintering area was considered to encompass Chesapeake Bay and Pamlico Sound. About 47 per cent of the first-year recoveries occurred in migration north and west of the State (Table 2). About 2 per cent were taken in areas off the beaten track for redheads coming into the Atlantic Flyway. Of the remainder, almost equal proportions were taken in New York and wintering areas to the south. These proportions varied from year to year. That for New York in the years from 1955-56 through 1958-59 was 68, 33, 47 and 67 per cent, respectively.

On Canandaigua Lake in 1956, records were kept showing the dates on which birds banded there were recaptured during the same year. Table 4 summarizes these records. Approximately half the birds trapped

TABLE 4. REDHEADS BANDED ON CANANDAIGUA LAKE IN 1956 AND RETRAPPED THERE DURING THE SAME YEAR

Banded			Retrapped (per cent)							
Month	Number	Sex	January only	February only	March only	January and February	January, February, March	January and March	February and March	Total
January	184	Male	16.9	9.8	5.5	9.8	3.3	1.8	4.9	51.0
	60	Female	21.6	11.6	1.7	8.3	3.3	..	..	46.5
	748	Male	..	14.2	11.8	..	..	..	4.9	29.9
	150	Female	..	10.1	10.7	..	..	..	..	29.1
March	152	Male	..	..	50.0	..	..	..	..	50.0
	107	Female	..	..	36.4	..	..	..	..	36.4

in January were trapped again before the end of March. Over one-third were retaken in January, a quarter in February, and nearly 15 per cent in March. Only 3 per cent became regular visitors to the traps.

The interchange between banding stations is shown in Table 5. Only 209 birds, or 2 per cent, were retrapped the same year at other stations in New York than that where they were banded. This does not suggest much population interchange between lakes. Movement of redheads back and forth between Canandaigua Lake and Seneca Lake, which are less than 20 miles apart, was observed visually. The proportion of the birds that were banded on Seneca Lake and retrapped on Canandaigua Lake was greater than that of birds banded on Canandaigua Lake and retrapped on Seneca Lake. The birds recaptured at Dunkirk Harbor were taken in March after signs of the spring migration had been observed and westward movement had begun.

TABLE 5. *REDHEADS BANDED AT ONE STATION AND RETRAPPED DURING THE SAME SEASON AT ANOTHER STATION IN NEW YORK FROM 1955 TO 1960*

Station where banded	Number banded	Retrapped				
		Cayuga Lake	Seneca Lake	Canandaigua Lake	Dunkirk Harbor	Total
Cayuga Lake	90	xx	0	0	0	0
Seneca Lake	3,629	1	xx	163	5	169
Canandaigua Lake	5,759	1	20	xx	1	30
Dunkirk Harbor	980	0	1	9	xx	10

TABLE 6. *REDHEADS BANDED AT CANANDAIGUA LAKE AND SENECA LAKE FROM 1955 TO 1959 AND RETRAPPED AT ONE OR THE OTHER OF THESE LAKES IN 1960**

Item	Year				
	1955	1956	1957	1958	1959
Banded at Seneca Lake					
Number banded	344	1,313	463	271	655
Number retrapped in 1960					
Seneca Lake	8	56	23	25	48
Canandaigua Lake	10	56	25	42	76
Banded at Canandaigua Lake					
Number banded	449	1,688	499	747	1,100
Number retrapped in 1960					
Canandaigua Lake	16	111	22	45	156
Seneca Lake	5	30	12	25	36

*In 1960 there were 591 new redheads banded at Seneca Lake, and 1,456 at Canandaigua Lake.

The recurrence at Canandaigua and Seneca Lakes in 1960 of redheads that were banded at these lakes from 1955 to 1959 is compared in Table 6. Of those banded at Seneca Lake, more were retrapped at Canandaigua Lake (6.9 per cent) than at Seneca Lake (5.3 per cent). Meanwhile 7.9 per cent of those banded at Canandaigua Lake were retrapped there and 2.4 per cent were retrapped on Seneca Lake. These birds seemed to be returning to a general area rather than a specific water unit. That greater numbers were retaken at Canandaigua Lake

probably was the result of the more intensive trapping done there—more traps, more trap sites and heavier baiting. Only 591 new birds were banded at Seneca Lake in 1960, while 1,356 were taken at Canandaigua Lake. The respective 5-year averages for the two lakes were 607 and 880.

MIGRATION ROUTE AND DISTRIBUTION OF RECOVERIES

The migration route of redheads into the Atlantic Flyway was illustrated by Weller (1961) and compared with that of the canvasback in a map modeled after one given by Stewart *et al.* (1958). The map illustrates that this portion of the redhead population, not unlike the canvasback, moves from Manitoba, North Dakota and Minnesota almost due east through Wisconsin and Michigan and along both shores of Lake Erie to funnel south and east from northwestern Pennsylvania and the Chautauqua Lake region of New York to Chesapeake Bay. A small segment reaches the eastern end of Lake Ontario (Canadian side) and the Finger Lakes of New York. Band returns for birds marked on their breeding range suggest that less than 25 per cent of the redheads that reach the Atlantic Flyway are subject to gunning in eastern Ontario and New York.

The distribution of first-year recoveries for redheads that were banded during the winter in New York (Table 2) shows essentially the same pattern of movement as that described by Weller (1964). About 19 per cent of these birds were subject to hunting within their breeding range. Another 20 per cent were taken in the areas touching the Great Lakes (exclusive of New York and that part of Ontario bordering on Lake Ontario). Less than 5 per cent were taken along the Canadian shore of Lake Ontario. About 2 per cent of the recovery records came from points scattered across the western flyways. The remainder were distributed nearly equally between New York and the other states of the Atlantic Flyway. Of the birds recovered south of New York the great majority were taken in Maryland, and in 1956-57 the number taken there exceeded that taken in New York.

Dates of recovery suggest that redheads banded during the winter in New York became available to gunning in Maryland about as soon as in New York. Aerial surveys showed migration patterns that closely followed that of recoveries. According to Stewart (1962) redheads first arrive in the Chesapeake Bay area in early October but become abundant between November 10 and December 10. Table 7 illustrates the progressive movement south and east as the fall advances, based on recovery records for birds banded in New York.

The relative numbers taken by hunting in New York and Maryland, according to one-third-month periods during the open season, are compared in Table 8. During October few redheads were taken in New

TABLE 7. DISTRIBUTION OF RECOVERIES BY HUNTING DURING THE 1955-56 TO 1960-61 SEASONS FOR REDHEADS BANDED DURING THE WINTER IN NEW YORK*

Recovery Location	Time of recovery by one-third-month periods													Total
	September		October			November			December			January		
	2	3	1	2	1	1	2	3	1	2	3	1	2	
North and west of New York														
Alberta	1	.	.	.	.	.	.	.	.	.	.	.	.	1
Saskatchewan	1	.	1	1	2	.	.	.	.	.	.	.	.	5
Manitoba	13	21	12	9	3	2	.	.	.	.	.	.	.	62
North Dakota	.	.	16	3	3	.	.	.	.	.	.	.	.	22
South Dakota	.	.	8	1	2	3	.	.	.	.	.	.	.	16
Minnesota	.	.	35	40	22	12	3	.	.	.	.	.	.	112
Wisconsin	.	.	4	9	11	10	6	.	.	.	.	.	.	40
Michigan	.	.	18	17	26	20	19	16	4	.	.	.	.	120
Ontario	.	6	6	8	12	13	15	21	12	12	.	.	.	106
Ohio	.	.	.	1	1	.	2	3	.	1	.	.	.	8
Sub-total	15	29	100	92	82	67	45	44	16	13	.	.	.	502
Per cent	3.0	5.8	19.9	18.3	16.3	13.3	9.0	8.6	3.2	2.6	.	.	.	100.0
New York														
New York	.	.	.	3	3	6	12	11	21	31	46	25	.	161
Per cent	.	.	.	1.9	1.9	3.7	7.4	6.8	13.0	19.1	28.5	15.5	.	100.0
South and east of New York														
Pennsylvania	.	.	.	.	3	.	1	1	2	1	.	.	.	8
New Jersey	.	.	.	.	.	.	.	1	1	.	5	1	.	8
Delaware	.	.	.	.	.	.	.	.	.	1	.	.	.	1
Maryland	.	.	.	.	.	2	3	9	20	29	29	33	20	151
Virginia	.	.	.	.	.	.	2	1	2	3	.	3	6	17
North Carolina	.	.	.	.	.	.	2	1	4	3	.	2	.	12
Florida	.	.	.	.	.	.	.	1	.	.	.	.	.	1
Quebec	.	.	.	.	.	.	1	.	.	.	.	.	.	1
Massachusetts	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Rhode Island	.	.	.	.	.	.	.	.	.	.	.	.	1	1
Connecticut	.	.	.	.	.	.	.	.	.	.	1	.	.	1
Sub-total	.	.	.	.	3	2	9	14	29	37	36	39	36	205
Per cent	.	.	.	.	1.5	1.0	4.4	6.8	14.1	18.0	17.6	19.0	17.6	100.0
Other														
Wyoming	.	.	.	1	.	.	.	.	.	.	.	.	.	1
Nebraska	.	.	.	1	.	.	.	.	.	.	.	.	.	1
Kansas	.	.	.	1	2	.	.	.	.	.	.	.	.	3
Iowa	.	.	.	1	.	.	.	.	.	.	.	.	.	1
Illinois	.	.	.	.	4	2	.	1	.	.	.	.	.	7

TABLE 7. (*continued*)

Recovery location	Time of recovery by one-third-month periods													Total
	September		October			November			December			January		
	2	3	1	2	3	1	2	3	1	2	3	1	2	
Missouri	..	..	..	..	1	..	..	..	..	..	..	..	..	1
Kentucky	..	..	..	..	..	1	..	..	..	..	..	..	..	1
Alabama	..	..	..	..	..	..	..	..	..	..	1	..	..	1
Louisiana	..	..	..	..	..	1	1	1	.	.	.	..	..	3
Texas	..	..	..	..	..	.	1	..	.	1	..	..	..	2
Sub-total	.	..	..	4	7	4	2	2	.	1	1	..	..	21
Per cent	.	..	..	19.0	33.4	19.0	9.5	9.5	.	4.8	4.8	..	..	100.0
Total	15	29	100	99	95	79	68	70	69	82	83	64	36	889
Per cent	1.7	3.3	11.2	11.1	10.7	8.9	7.7	7.9	7.8	9.2	9.3	7.2	4.0	100.0

* Does not include some records in Table 2 for which actual date of recovery was not known.

York, and there was no open season in Maryland during this month in any of the years studied. During November the take in both states was proportional to the days of hunting opportunity. Through December and early January, recoveries increased in relation to the days of opportunity, but the increase was greater in New York. The high rate of harvest in relation to opportunity in New York for the last third of December and the first third of January is misleading. Many of these birds were taken in 1958-59 when the second part of a split season was accompanied by almost ideal weather for hunting diving ducks, i.e., extreme cold, winds and storms. The total recovery per hunting day for the entire period was almost identical——0.44 in New York and 0.42 in Maryland.

A clue to migration routes and possible reasons why this redhead population became available to hunting in Maryland as soon as in New York is the date of banding in relation to the place of recovery. If some of these birds flew south directly to Chesapeake Bay, but worked northward through the Finger Lakes in late winter, it is possible that the banding done in New York was really sampling two populations. This hypothesis may be examined by comparing the recoveries for New York and Maryland alone (Table 9). These records show that 58 per cent of the recoveries for birds banded from January through March 10 came from New York, while nearly 75 per cent of those for birds banded after March 10 came from Maryland. It appears then that redheads present in New York in January and February were in part a

TABLE 8. COMPARATIVE RECOVERIES IN NEW YORK AND MARYLAND, ACCORDING TO ONE-THIRD-MONTH PERIOD AND NUMBER OF HUNTING DAYS, FOR REDHEADS BANDED DURING THE WINTER IN NEW YORK FROM 1955 TO 1960 AND SUBSEQUENTLY SHOT DURING THE SEASONS OF 1955-56 TO 1960-61

Item	Month and period											Total
	October		November			December			January			
	1	2	1	2	3	1	2	3	1	2		
New York												
Recoveries												
Number	3	3	6	12	11	21	34	46	25	..		161
Per cent	1.9	1.9	3.7	7.5	6.8	11.9	19	28.5	15.5	..		100.0
Hunting days*	31	66	60	60	55	30	30	18	8	0		364
Recoveries per day	0.10	0.05	0.10	0.20	0.20	0.66	1.01	2.56	3.12	..		0.44
Maryland												
Recoveries												
Number	..	..	2	3	9	20	29	29	43	29		154
Per cent	..	..	1.3	1.9	5.9	13.0	18.8	18.8	21.5	18.8		100.0
Hunting days*	0	0	12	37	60	60	60	66	55	20		370
Recoveries per day	..	..	0.17	0.08	0.15	0.33	0.48	0.44	0.60	1.45		0.42

* Total number for all seasons combined; selection of split season in New York in 1958-59 reduced hunting there by 6 days.

TABLE 9. COMPARATIVE HARVEST IN NEW YORK AND MARYLAND DURING SEASONS FROM 1955-56 TO 1960-61 FOR REDHEADS BANDED DURING THE WINTER IN NEW YORK FROM 1955 TO 1960 ACCORDING TO PERIOD OF BANDING

Item	Time of banding by one-third-month period									Total
	January			February			March			
	1	2	3	1	2	3	1	2	3	
Recoveries										
New York	5	25	28	23	20	22	22	9	8	161
Maryland	3	20	18	13	19	9	22	21	26	151
Percentage in New York	62.5	55.5	60.9	62.9	51.3	71.0	50.5	27.3	23.5	51.1

terminal wintering population and in part birds that tended to winter south of New York. Perhaps up to a quarter of the birds wintered either place depending on weather or flock leadership. Recovery rates in the two states for birds trapped each month were nearly equal.

SEX RATIOS AMONG THE BIRDS BANDED

The proportion of females among the redheads banded ranged from about 16 to 29 per cent (Table 10). From 1955 through 1957 it increased, and from 1958 through 1960 it declined. The average for the six years was 21.5 per cent. This indicated that production during the bumper years on the prairie potholes was good and that the addition of young was bringing the sex ratio into better balance. Supplemental data included in Table 10 give the sex ratios of redheads banded from 1961 to 1964, a period when no hunting was allowed on this species in the United States. The numbers trapped in 1961 and 1962 were too few to constitute good samples, but the samples for 1963 and 1964 were large and comparable to those for 1955 to 1960. They indicate no change in the sex ratio. Similar sex ratios were observed when flocks were studied with field glasses and telescopes. Therefore it is assumed that

Table 10. Comparative Proportions of Females Among Redheads Banded in New York from 1955 to 1960 and from 1961 to 1964

Year	Number banded			Proportion of females (per cent)			
	Male	Female	Total	January	February	March	Total
1955–1960							
1955	705	201	906	18.9	18.2	27.2	22.2
1956	2,549	827	3,376	26.7	19.1	30.0	24.5
1957	858	344	1,201	28.9	24.9	30.5	28.6
1958	887	246	1,133	28.1	19.9	18.6	21.7
1959	1,520	303	1,823	17.0	15.6	17.2	16.6
1960	1,640	309	1,949	17.7	12.6	16.4	15.8
Average	xxx	xxx	xxx	23.7	17.8	23.0	21.5
Total banded	8,159	2,229	10,388	3,122	3,490	3,776	10,388
1961–1964							
1961	177	73	250	29.1	23.4	42.9	29.2
1962	355	87	442	19.8	25.4	12.7	19.7
1963	1,855	405	2,260	20.0	16.2	11.4	17.9
1964	1,978	740	2,718	27.3	24.8	30.6	27.2
Average	xxx	xxx	xxx	24.1	21.3	19.5	23.0
Total banded	4,365	1,305	5,670	4,009	703	878	5,670

males and females were being taken in the traps in proportion to their occurrence.

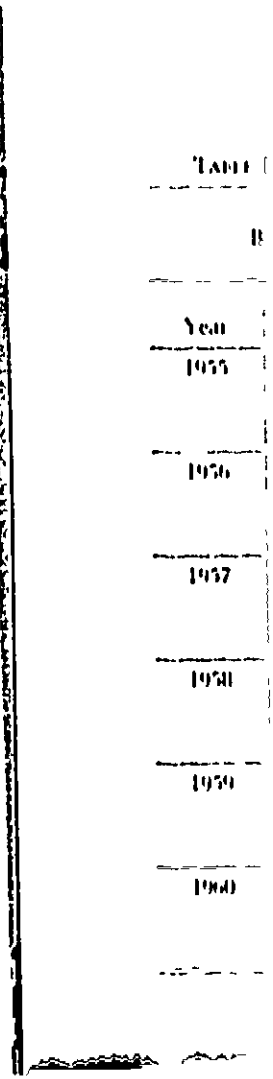
Recovery locations indicated that redheads banded during the last two-thirds of March were four times as likely to be taken south of New York as in New York. Birds banded during January and February were 1.7 times as likely to be taken in New York. Sex ratios for those trapped in March showed no difference either by one-third-month periods or in comparison with the annual totals. This suggests that there was no difference between the proportion of females in the population wintering in New York and that in populations wintering farther south.

MORTALITY AND SEX DIFFERENTIALS

First-year recovery rates for redheads banded from 1955 through 1958 were relatively constant (Table 11), but in 1959 the rate dropped to 2.8 per cent. In both the 1958-59 and 1959-60 seasons only one redhead or canvasback was allowed in the bag. The selection of a late split season in New York in 1958-59 and excellent weather for hunting diving ducks countered the effect of the reduced bag in that year. These rates were higher than those for canvasbacks on the same areas from 1955-56 to 1957-58 (7.4, 6.6 and 6.1 per cent, respectively) as reported by DeGraff *et al.* (1961). In 1958-59 the rate for canvasbacks jumped to 12.0 per cent under the late split season. Mortality rates based on three hunting seasons do not give a full picture since the redhead may live to three times that age. Rates calculated from Table 11 only suggest that the females had a higher rate than the males. The canvasback records, however, showed a definitely higher mortality rate for females than males.

The open seasons and bag limits in effect during these years are summarized in Table 12. Since redheads usually arrive in New York earlier in the fall than canvasbacks, seasons that extend only into mid-December would tend to provide a higher rate of harvest by hunting for redheads than canvasbacks. The proportion of the canvasback harvest that occurs in New York is usually about 29 per cent, but in 1958-59 it was 72 per cent. For redheads, the corresponding figures were 21 per cent and 42 per cent.

Records for retrapped birds also indicate mortality rates. Such records from 1956 through 1964 for birds banded from 1955 to 1960 are given in Table 13. Only records from Canandaigua Lake and Seneca Lake are used because personnel and effort remained more constant at these two stations from 1955 through 1961 than at the other stations shown in Table 1. These data show a more rapid loss of females than males. The first year after banding, only two-thirds as many females as males were retrapped, and over all nine years only half as many were retrapped.



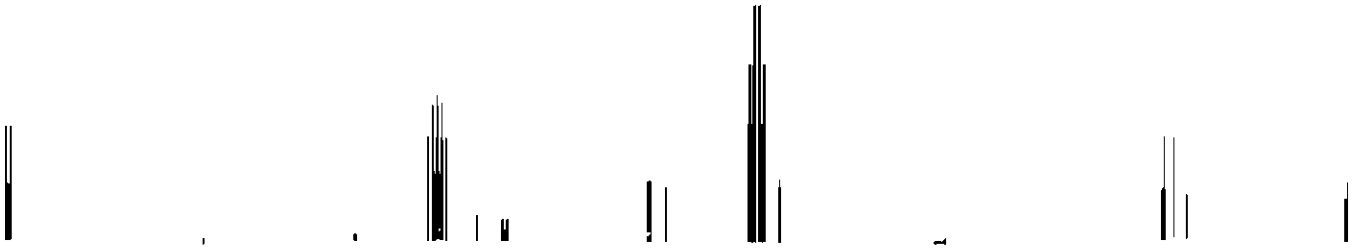


TABLE 11. RECOVERIES BY HUNTING, ACCORDING TO YEAR OF BANDING AND YEAR OF RECOVERY, FOR REDHEADS BANDED IN NEW YORK

Banded			Recovered													
			1955-56		1956-57		1957-58		1958-59		1959-60		1960-61		Total	
Year	Number	Sex	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent	Number	Per cent
1955	701	Male	60	8.5	27	3.8	10	1.4	25	3.6	6	0.9	2	0.3	130	18.5
	201	Female	19	9.5	9	4.5	6	3.0	2	1.0	1	0.5	..	..	37	18.4
	905	Total	79	8.7	36	4.0	16	1.8	27	3.0	7	0.8	2	0.2	167	18.5
1956	2,549	Male	..	..	169	6.6	116	4.6	71	2.7	46	1.8	6	0.2	403	16.0
	827	Female	..	..	69	8.3	32	3.9	18	2.2	8	1.0	..	..	127	15.4
	3,376	Total	..	..	238	7.0	148	4.4	89	2.6	54	1.6	6	0.2	533	15.8
1957	838	Male	..	..	..	..	72	8.4	31	3.6	19	2.2	2	0.2	121	14.5
	343	Female	..	..	..	..	29	8.5	6	1.7	4	1.2	1	0.3	40	11.7
	1,201	Total	..	..	..	..	101	8.4	37	3.1	23	1.9	3	0.2	161	13.7
1958	907	Male	..	..	..	..	..	..	68	7.7	23	2.6	4	0.5	95	10.7
	216	Female	..	..	..	..	..	..	26	10.6	9	3.7	..	..	35	14.2
	1,133	Total	..	..	..	..	..	..	94	8.3	32	2.8	4	0.4	130	11.5
1959	1,520	Male	..	..	..	..	..	..	..	..	41	2.7	3	0.2	44	2.9
	303	Female	..	..	..	..	..	..	..	..	10	3.3	..	..	10	3.3
	1,823	Total	..	..	..	..	..	..	..	..	51	2.8	3	0.2	54	1.0
1960	1,641	Male	..	..	..	..	..	..	..	..	..	..	2	0.1	2	0.1
	309	Female	..	..	..	..	..	..	..	..	..	..	2	0.6	2	0.6
	1,950	Total	..	..	..	..	..	..	..	..	..	..	4	0.2	4	0.2

TABLE 12. OPEN SEASONS AND BAG LIMITS FOR REDHEAD AND CANVASBACK IN EITHER IN NEW YORK FROM 1955-56 TO 1960-61

Year	Open season		Bag limit	
	Dates	Total days	Total ducks	Redhead and canvasback
1955-56	October 15-December 24	70	4	4 in aggregate
1956-57	October 15-December 23	70	4	4 in aggregate
1957-58	October 19-December 27	70	4	4 in aggregate
1958-59	October 16-November 25 and December 27-January 8	51	4	2 in aggregate
1959-60	October 16-December 4	50	3	1 in aggregate
1960-61	October 14-December 2	50	3	None

The recovery data in Table 11 show that female redheads were more vulnerable than males to hunting during the first fall following banding. The dates of recovery also indicate that females were somewhat more likely to be shot early in the season than males. Among the birds banded in 1955 recovery rates were also higher for females during the second and third seasons, but they were higher for males after that. At the end of six shooting seasons the total recovery rates for males and females were nearly equal, i.e., 18.5 and 18.4 per cent, respectively. For the birds banded in 1956, recovery rates were higher for males than females during all seasons except the first, but again the total recovery rates were similar, i.e., 16.0 per cent for males and 15.4 per cent for females. Total recovery rates for later years are less meaningful because of fewer years' records and reduced bag limits. First-year recoveries for the six years averaged 5.05 per cent for males and 6.95 per cent for females indicating that the females were 1.38 times as vulnerable to hunting as the males. That males and females provided nearly equal returns after 6 years indicated that the observed differential in sex ratio was partly due to gunning, most females being removed from the population in about 3 years while many males lived much longer.

Bellrose *et al.* (1961) in their very thorough review of sex and age ratios in North American ducks brought together a wealth of sex ratio data, some of which pertains to redheads. They cited Sowls (1955) as showing that 53.8 per cent of 636 redhead ducklings at hatching were males. Hunter bag checks in Manitoba and the Mississippi Flyway states were reported to include 46.6 to 52.8 per cent males in the immature redheads taken during the years 1946 to 1949 in samples totalling 2,992 birds. The average of 50.7 per cent males in the bag suggests a differential harvest of females over males when compared with the sex ratio at hatching. With juveniles making up 85.3 per cent of the

TABLE 13. SURVIVAL OF REDHEADS IN TERMS OF PROPORTIONS OF BIRDS BANDED AT CANANDAIGUA AND SENECA LAKES FROM 1955 TO 1960 THAT WERE RETRAPPED, ACCORDING TO NUMBER OF YEARS AFTER BANDING, UNTIL 1964

Birds banded		Number of years after banding								
Year	Number	1	2	3	4	5	6	7	8	9
Males retrapped										
1955	602	72	13	15	39	39	6	3	3	0
1956	2,255	92	65	240	231	33	20	13	13	.
1957	671	28	68	69	21	8	32	0	..	.
1958	891	164	116	25	18	69	27	.	..	..
1959	1,473	284	50	41	161	89	.	.	..	..
1960	1,611	62	19	221	85	..	..	..	..	..
Total	702	369	601	557	229	85	60	21	0	
Per cent*	9.4	5.0	8.1	7.5	3.9	2.0	1.7	0.7	0.0	
Females retrapped										
1955	180	15	3	0	2	1	0	0	0	0
1956	666	24	9	23	20	5	2	1	1	..
1957	291	4	18	18	5	1	8	6	.	..
1958	214	32	21	7	3	7	0	..	..	..
1959	292	32	11	3	14	3	..	..	..	
1960	389	18	10	17	5	..	..	..	..	..
Total	125	72	70	49	19	10	7	1	0	
Per cent*	6.4	3.7	3.6	2.5	1.2	0.7	0.6	0.1	0.0	
Cumulative number banded										
Male	7,446	7,446	7,446	7,446	7,446	5,805	4,342	3,328	2,857	602
Female	1,912	1,912	1,912	1,912	1,912	1,633	1,351	1,137	817	180

* Proportion of cumulative number banded for each period.

§ Figures represent number of birds potentially available for retrapping in each case with no allowance for mortality. For the 1- to 4-year periods, the figures are the same because records for birds banded after 1960 were not used.

harvest, marked differentials in sex ratio would be expected in the population reaching New York.

The records of a banding station on Seneca Lake where all redheads were examined cloacally are summarized in Table 14. The proportions of females were similar for the adults and juveniles banded, averaging 22.6 and 24.2 per cent, respectively, for the 5 years from 1955 to 1959. Apparently the immature females had been subject to heavy mortality before reaching New York. Based on the same records, the proportions of juveniles for the two sexes are summarized in Table 15. Among the males the average declined from January to March.

TABLE 14. PROPORTION OF FEMALES, BASED ON CLOACAL EXAMINATION, AMONG REDHEADS BANDED AT SENECA LAKE FROM 1955 TO 1959*

Year	January				February				March				Total			
	Adult		Juvenile		Adult		Juvenile		Adult		Juvenile		Adult		Juvenile	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Number banded																
1955	126	26	6	3	38	11	13	3	61	21	11	12	225	60	30	18
1956	363	165	193	52	258	71	79	17	73	27	16	9	694	263	278	78
1957	121	48	96	45	51	10	29	13	31	5	2	1	206	71	127	59
1958	..	..	..	..	100	14	42	5	93	14	8	5	193	28	40	10
1959	31	7	5	0	373	70	42	1	88	21	6	0	192	106	53	4
Total	641	246	290	100	823	192	195	42	346	89	43	27	1,810	528	528	169
Proportion of females (per cent)																
1955	17.1		33.3		22.9		18.8		27.4		52.2		21.1		37.5	
1956	31.3		21.3		21.6		17.7		27.0		36.0		27.5		21.9	
1957	28.4		31.9		25.0		30.9		13.9		11.3		25.6		31.7	
1958	..		..		12.3		13.5		13.1		38.5		12.7		20.0	
1959	18.4		0.0		17.3		8.7		19.3		0.0		17.7		7.0	
Total	27.7		25.6		18.9		17.7		20.6		38.5		22.6		21.2	

* Station operated by Dr. Richard A. Ryan of Hobart College.

TABLE 15. PROPORTION OF JUVENILES, BASED ON CLOACAL EXAMINATION, AMONG MALE AND FEMALE REDHEADS BANDED AT SENECA LAKE FROM 1955 TO 1959*

Year	January		February		March		Total	
	Male	Female	Male	Female	Male	Female	Male	Female
1955	1.5	10.3	25.5	21.4	15.1	31.2	11.8	24.1
1956	33.5	24.0	23.4	19.3	10.6	25.0	28.6	22.9
1957	41.2	40.4	31.9	41.9	6.1	16.7	30.1	45.4
1958	...	...	21.2	26.3	7.9	26.3	17.2	26.3
1959	13.8	0.0	10.1	4.9	6.4	0.0	9.7	3.6
Total	31.1	28.9	19.2	17.9	11.1	23.1	22.6	24.2

* Derived from figures for numbers banded given in Table 14.

Among the females there was a less pronounced decline, but the sample was small. During January no birds were handled that could not be definitely classified as adult or juvenile. In February some juveniles, and in March more, were taking on adult characters. Where doubt existed as to age, the birds were classed as adult. Changing characters on males were observed more easily and perhaps sooner than on the females.

DISCUSSION

Because they are both diving ducks that frequent the larger water areas of upstate New York that stay open through the winter, there is a tendency to consider redheads and canvasbacks as a common group. This is only partially justified. The data presented here show how the redhead differs, with respect to migration and the effects of hunting as reflected in the records for birds banded in New York during the winter, from the canvasback as discussed by DeGraff *et al.* (1961). They also indicate some of the problems in managing this species that crosses country and flyway boundaries.

Redheads reared in the eastern and northern portions of their breeding range, primarily Manitoba, Minnesota and eastern North Dakota, tend to winter in the Atlantic Flyway including New York. Canvasbacks that reach New York follow the same pattern, but a larger proportion of this species than of the redhead probably comes from Saskatchewan. In fall migration the two species follow similar routes through the Great Lakes region. Based on band recoveries the peaks of movement of the two species roughly coincide. Redheads perhaps move earlier and more gradually. Both may be taken in New York in October in small numbers. The redhead harvest increases in early November and then may jump sharply with the arrival of mid-November flights. The canvasback harvest does not become significant until late November.

Both species become progressively more vulnerable to gunning in December if the weather becomes severe. Harvest rates, especially for the canvasback, are controlled more by weather than by the relative numbers of birds in the area. More canvasbacks than redheads are normally observed during aerial surveys in November in New York, yet redheads are more likely to be shot. Conversely, late December and early January shooting results in more canvasbacks than redheads being taken.

For birds banded during the winter in New York, about 56 per cent of the recoveries for redheads came from north and west of this State, while the corresponding figure for canvasbacks was 24 per cent. Recoveries in New York amounted to 18 per cent and 51 per cent, respectively. These represented total recoveries and included those during the split season in 1958-59 when canvasbacks were very vulnerable to gunning in this State. If the data for 1958-59 are omitted, the proportions would become 43 per cent for the area to the north and west and 29 per cent for New York. But such an adjustment would have no significant effect on the recovery values for the redhead. For both species, only 20 to 30 per cent of the recoveries came from south and east of New York.

The lateness of the second half of the split season in 1958-59 (December 27-January 8) resulted in the recovery of banded canvasbacks rising to 12 per cent, almost double the average for the three preceding seasons. That for redheads, however, remained essentially unchanged. Since the bag limits for both species were lowered in that year, the lack of reduction in recovery rate for the redhead represented some compensating increase in the harvest which applied to redheads to a much greater degree than to canvasbacks. The data suggest that the dates of the open season in New York could be adjusted with respect to the number of shooting days allowed in late December and January so as to reduce the harvest of redheads only slightly while reducing that of canvasbacks substantially.

These data for the redhead and those reported by DeGraff *et al.* (1961) for the canvasback both suggest that gunning results in a relatively higher loss of juvenile females than of juvenile males. This loss occurs primarily in the prairie states and provinces, and by the time birds of the year reach New York males predominate. Similarly, for winter-banded birds of both species, recoveries by hunting during the first fall after banding is higher for females than for males. As Bellrose *et al.* (1961) have pointed out, the high mortality rates among immature redheads result in a relatively large proportion of old birds among the adults and a preponderance of males. Hickey (1952) concluded that hunting losses amount to about 50 per cent for juveniles but only about 20 to 30 per cent for adults, while annual mortality rates are about 70 per cent for juveniles and 55 per cent for adults. In the present study

adult females were found to be 1.38 times as vulnerable to gunning as adult males.

There is need for hunting regulations that would reduce the high loss of female redheads that occurs early in the season and that is most pronounced during the first year or two of life. In any case, hunters could help by passing up females in favor of males. In New York, this would be especially applicable in the Finger Lakes region.

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